

Appl. No. 10/006,578  
Reply to Office action of 02/19/2004

### **REMARKS**

Entry of the above amendment and reconsideration of the above-referenced application in view of the above amendment, and of the following remarks, is respectfully requested.

Claims 1, 4-9, and 11-16 are pending in this case. Claims 1 and 9 are amended herein.

The Examiner rejected claims 1, 4-9, 11-16 under 35 U.S.C. § 103(a) as being unpatentable over Sandhu et al. (U.S. Patent 6,291,340) in view of Zhang et al. (U.S. Patent 6,436,819).

Applicant respectfully submits that claim 1 is patentable over Sandhu in view of Zhang as there is no disclosure or suggestion in the references of after annealing the conductive liner, treating the conductive liner with hydrogen to reduce a native oxide that forms on said conductive liner. Sandhu teaches a single step of annealing in an ambient gas such as nitrogen, argon, ammonia, or hydrogen either after the deposition of the TiN layer or after the deposition of the Ti layer. Sandhu does not teach treating the conductive liner with hydrogen after annealing the conductive liner. Zhang teaches a method for forming a metal nitride/metal stack which includes a treatment step in a nitrogen-containing ambient. The plasma treatment adds nitrogen to a top portion of the metal layer. This reduces the microstructure mismatch and densifies and reduces impurities in the deposited nitride layer. While Zhang teaches that the nitrogen containing ambient can also contain hydrogen, e.g.,  $\text{NH}_3$  or  $\text{N}_2/\text{H}_2$ , the combination of Zhang with Sandhu does not suggest treating the conductive liner with hydrogen to reduce a native oxide that forms on said conductive liner, as required by the claim. Zhang teaches the use of hydrogen with nitrogen for a plasma nitridation process (adding nitrogen to the layers). This teaching combined with Sandhu does not suggest a hydrogen treatment to reduce a native oxide. Accordingly, Applicant respectfully

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submits that claim 1 and the claims dependent thereon are patentable over the references.

Applicant respectfully submits that claim 9 is patentable over Sandhu in view of Zhang as there is no disclosure or suggestion in the references of treating titanium with hydrogen prior to an annealing step to reduce a native oxide that forms on the titanium, as required by claim 9. Sandhu teaches a single step of annealing in an ambient gas such as nitrogen, argon, ammonia, or hydrogen either after the deposition of the TiN layer or after the deposition of the Ti layer. Sandhu does not teach treating the conductive liner with hydrogen after annealing the conductive liner. Zhang teaches a method for forming a metal nitride/metal stack which includes a treatment step in a nitrogen-containing ambient. The plasma treatment adds nitrogen to a top portion of the metal layer. This reduces the microstructure mismatch and densifies and reduces impurities in the deposited nitride layer. While Zhang teaches that the nitrogen containing ambient can also contain hydrogen, e.g.,  $\text{NH}_3$  or  $\text{N}_2/\text{H}_2$ , the combination of Zhang with Sandhu does not suggest treating titanium with hydrogen prior to an annealing step to reduce a native oxide that forms on the titanium, as required by the claim. Zhang teaches the use of hydrogen with nitrogen for a plasma nitridation process (adding nitrogen to the layers). This teaching combined with Sandhu does not suggest a hydrogen treatment to reduce a native oxide. Accordingly, Applicant respectfully submits that claim 9 and the claims dependent thereon are patentable over the references.

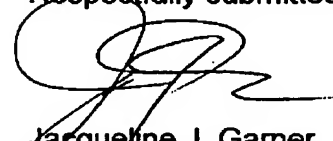
The other reference cited by the Examiner has been reviewed, but is not felt to come within the scope of the claims as amended.

In light of the above, Applicant respectfully requests withdrawal of the Examiner's rejections and allowance of claims 1, 4-9, and 11-16. If the Examiner has any questions or other correspondence regarding this application, Applicant requests that the

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Examiner contact Applicant's attorney at the below listed telephone number and address.

Respectfully submitted,



Jacqueline J. Garner  
Reg. No. 36,144

Texas Instruments Incorporated  
P. O. Box 655474, M.S. 3999  
Dallas, Texas 75265  
Phone: (214) 532-9348  
Fax: (972) 917-4418